

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A charged beam exposure for delineating patterns of [[a]] systems on [[a]] substrates to describe the systems in [[a]] logic expressions, to convert the logic expressions into [[a]] connections of standard cells, and to delineate patterns of the standard cells on the substrates, comprising:

a beam generation source generating [[a]] charged beams;

[[a]] Character Projection (CP) apertures having shaping holes of the charged beams having shapes of one hundred or more characters having shapes of the standard cells;

standard cell library recording means for recording a standard cell library having an information configured to ~~designing~~ design the patterns of the systems by using the standard cells having functions, shapes of outlines, and input/output positions of the standard cells, and for recording the standard cell library having first placement positions of the shaping holes on said CP apertures related to the standard cells corresponding to the shaping holes;

Character Projection (CP) aperture decision means for conducting logic synthesis for the CP apertures using the standard cells corresponding to the shaping holes placed on first placement positions on the respective CP apertures, and for selecting one of the CP apertures having a throughput higher than a desired throughput in delineating one of the patterns of the systems on the substrates based on the standard cell library;

placement and routing means for calculating second placement positions of the standard cells on the substrates, the standard cells corresponding to the shaping holes provided on the selected one of the CP apertures based on the standard cell library;

pattern data recording means for recording second placement positions of the standard cells on the substrates, the second placement positions associated with the standard cells corresponding to the first placement positions on the selected one of the CP apertures;

a character select deflector irradiating the charged beams onto the shaping holes at the first placement positions on the selected one of the CP apertures; and

an objective deflector irradiating the charged beams onto the second placement positions on the substrates.

2. (Currently Amended) [[An]] The exposure as in claim 1, further comprising:
a first shaping aperture rectangularly shaping an irradiation pattern of one of the charged beams to said CP aperture.

3. (Currently Amended) [[An]] The exposure as in claim 1, further comprising:
a demagnifying lens demagnifying the irradiation pattern of [[the]] one of the charged ~~electron~~ beams on the substrate.

4. (Currently Amended) [[An]] The exposure as in claim 1, wherein said standard cell library recording means further records input and output positions of signals of the standard cells.

5. (Currently Amended) ~~[[An]]~~ The exposure as in claim 1, wherein ~~said~~ one of the CP apertures further has an opening for a variable shaped beam (VSB).

6. (Currently Amended) ~~[[An]]~~ The exposure as claimed in claim 1, wherein the shaping holes have a shape of one of the standards cell having a higher frequency of use or a shape of one of the standard cells ~~having a higher effect of~~ corresponding to reducing the a number of shots by CP exposure ~~than by VSB~~ exposure.

7. (Currently Amended) An exposure pattern data generation apparatus for delineating patterns of ~~[[a]]~~ systems on ~~[[a]]~~ substrates to describe the systems in ~~[[a]]~~ logic expressions, to convert the logic expressions into ~~[[a]]~~ connections of standard cells, and to delineate patterns of the standard cells on the substrates, comprising:

Character Projection(CP) aperture creation means for creating CP apertures having shaping holes corresponding to one hundred or more characters having shapes of the standard cells;

standard cell library recording means for recording a standard cell library having an information configured to ~~designing~~ design the patterns of the systems by using the standard cells having functions, shapes of outlines, and input/output positions of the standard cells, and for recording the standard cell library having first placement positions of the shaping holes on said CP apertures related to the standard cells corresponding to the shaping holes;

Character Projection (CP) aperture decision means for conducting logic synthesis for the CP apertures using the standard cells corresponding to the shaping holes placed on first placement positions on the respective CP apertures, and for selecting one of the CP apertures having a throughput higher than a desired throughput in delineating one of the patterns of the systems on the substrates based on the standard cell library;

placement and routing means for calculating second placement positions of the standard cells on the substrates, the standard cells corresponding to the shaping holes provided on the selected one of the CP apertures based on the standard cell library; and

pattern data recording means for recording second placement positions of the standard cells on the substrates, the second placement positions associated with the standard cells corresponding to the first placement positions on the selected one of the CP apertures.

8. (Currently Amended) ~~An~~ The apparatus as in claim 7, further comprising: variable shaped beam (VSB) [[VSB]] exposure data conversion means for converting data into data capable of being used by an exposure to conduct ~~variable-shaped-beam (VSB)~~ VSB exposure to the standard cells which cannot be subject to exposure using the shaping holes.

9. (Currently Amended) ~~An~~ The apparatus as in claim 7, wherein said CP aperture decision means comprises:

standard cell extraction means for extracting the standard cells;

logic synthesis means for conducting synthesized logic using the extracted standard cells; and

constraints and ~~[[the]]~~ a like determination means for determining whether the logic synthesis satisfies a specification.

10. (Currently Amended) ~~An~~ The apparatus as in claim 9, wherein

said CP aperture decision means further comprises:

CP aperture creation means for creating a new CP aperture if the CP apertures cannot satisfy the specification.

11. (Currently Amended) ~~An~~ The apparatus as in claim 7, wherein

said placement and routing means calculates wiring routes among the placed standard cells.

12. (Currently Amended) ~~An~~ The apparatus as in claim 7, further comprising:

first standard cell library recording means for recording magnitudes, functions and performances of the standard cells, an identification code of one of the CP apertures on which the shaping holes having the shapes of the standard cells are formed and the first placement positions, and for providing the recorded magnitudes, functions and performances of the standard cells, the identification code and the first placement positions to said CP aperture decision means.

13. (Currently Amended) ~~An~~ The apparatus as in claim 7, further comprising:
second standard cell library recording means for recording shapes and magnitudes of outlines of the standard cells, positions of input and output signals, an identification code of one of the CP apertures on which the shaping holes having the shapes of the standard cells are formed and the first placement positions, and for providing the recorded shapes and magnitudes of the outlines of the standard cells, positions of the input and output signals, identification code and the first placement positions to said placement and routing means.

14. (Currently Amended) ~~An~~ The apparatus as in claim 13, further comprising:
pattern data recording means for recording the second placement positions, the identification code and wiring routes among the standard cells provided from said placement and routing means.

15. (Currently Amended) An exposure pattern data generation method for delineating patterns of [[a]] systems on [[a]] substrates to describe the systems in [[a]] logic expressions, to convert the logic expressions into [[a]] connections of standard cells, and to delineate patterns of the standard cells on the substrates, comprising:
creating Character Projection (CP) apertures having shaping holes corresponding to one hundred or more characters having shapes of the standard cells;
recording a standard cell library having an information configured to ~~designing~~ design the patterns of the systems by using the standard cells having functions, shapes of outlines, and input/output positions of the standard cells, and recording the standard

cell library having first placement positions of the shaping holes on said CP apertures related to the standard cells corresponding to the shaping holes;

conducting logic synthesis for the Character Projection (CP) apertures using the standard cells corresponding to the shaping holes placed at first placement positions on the respective CP apertures on the substrate based on the standard cell library;

selecting [[a]] one of the CP apertures having a throughput higher than a desired throughput in delineating one of the patterns of the systems on the substrates from the CP apertures on the substrates based on the standard cell library;

calculating second placement positions of the standard cells on the substrates, the standard cells corresponding to the shaping holes provided on the selected one of the CP apertures on the substrates based on the standard cell library; and

recording second placement positions of the standard cells on the substrates, the second placement positions associated with the standard cells corresponding to the first placement positions on one of the selected CP apertures.

16. (Currently Amended) [[A]] The method as in claim 15, further comprising:
converting data into data capable of being used by an exposure to conduct variable shaped beam (VSB) exposure to the standard cells which cannot be subjected to exposure using the shaping holes.

17. (Currently Amended) [[A]] The method as in claim 15, wherein

said conducting logic synthesis for CP apertures using standard cells corresponding to shaping holes placed at first placement positions on the respective CP apertures comprises:

extracting the standard cells; and

conducting logic synthesis using the extracted standard cells, and

said selecting a CP aperture used for exposure from the CP apertures

comprises:

determining whether the synthesized logic satisfies a specification.

18. (Currently Amended) [[A]] The method as in claim 15, wherein

said conducting logic synthesis for CP apertures using standard cells

corresponding to shaping holes placed at first placement positions on the respective CP apertures further comprises:

creating a new CP aperture if the CP apertures cannot satisfy the specification.

19. (Currently Amended) [[A]] The method as in claim 15, wherein

the calculating second placement positions of the standard cells on a substrate,

the standard cells corresponding to the shaping holes provided on the selected CP aperture further comprises:

calculating wiring routes among the placed standard cells.

20. (Currently Amended) [[A]] The method as in claim 15, further comprising:

recording magnitudes, functions, outline shapes and outline magnitudes of the

standard cells, positions of input and output signals, identification codes of the CP apertures on which the shaping holes having the shapes of the standard cells are formed and the first placement positions.

21. (Currently Amended) [[A]] The method as in claim 15, further comprising:
recording the second placement positions, identification codes and wiring ~~routes~~
routes among the standard cells.

22. (New) The exposure as in claim 1, wherein
the standard cells on the CP apertures are listed in an order of a frequency of
using each of the standard cells used by the systems, and
in an order according to a difference between a variable shaped beam (VSB)
shot number, defined as a number of exposures of a one of the standard cells with VSB
exposure, and a CP shot number, defined as a number of exposures of the one of the
standard cells with CP exposure.

23. (New) The exposure as in claim 1, wherein said CP aperture decision means
further comprises:

a CP aperture creation means for listing the standard cells in an order of
frequency of use of each of the standard cells used by the systems, and in an order
according to a difference between a variable shaped beam (VSB) shot number, defined
as a number of exposures of a one of the standard cells with VSB exposure, and a CP

shot number, defined as a number of exposures of the one of the standard cells with CP exposure; and

means for creating a new CP aperture based on the listed standard cells if the CP apertures cannot satisfy the desired throughput.

24. (New) The exposure as in claim 1, wherein
the systems are logic products, and
the standard cells have shapes of the characters having shapes corresponding to the shaping holes are circuits having functions making logic expressions for logic synthesis.

25. (New) The exposure as in claim 1, wherein
the standard cells on the CP apertures are listed in effective order of CP effectiveness defined as a quotient of a product divided by a CP shot number defined as a number of exposures of the one of the standard cells with CP exposure, the product being a result of multiplying a frequency of use of each of the standard cells used by the systems by a difference between a number of variable shaped beam (VSB) shots, defined as a number of exposures of a one of the standard cells with VSB exposure, and the CP shot number.

26. (New) The exposure as in claim 1, further comprising:

variable shaped beam (VSB) exposure data conversion means for converting data into data capable of being used for an exposure to conduct VSB exposure of the standard cells which cannot be subjected to exposure using the shaping holes.

27. (New) The apparatus as in claim 7, wherein
the standard cells on the CP apertures are listed in an order of a frequency of using each of the standard cells used by the systems, and
in an order according to a difference between a variable shaped beam (VSB) shot number, defined as a number of exposures of a one of the standard cells with VSB exposure, and a CP shot number, defined as a number of exposures of the one of the standard cells with CP exposure.

28. (New) The apparatus as in claim 7, wherein
the systems are logic products, and
the standard cells have shapes of the characters having shapes corresponding to the shaping holes are circuits having functions making logic expressions for logic synthesis.

29. (New) The apparatus as in claim 7, wherein:
the standard cells on the CP apertures are listed in effective order of CP effectiveness defined as a quotient of a product divided by a CP shot number defined as a number of exposures of the one of the standard cells with CP exposure, the product

being a result of multiplying a frequency of use of each of the standard cells used by the systems by a difference between a number of variable shaped beam (VSB) shots, defined as a number of exposures of a one of the standard cells with VSB exposure, and the CP shot number.

30. (New) The method as in claim 15, further including:

listing the standard cells on the CP apertures in an order of a frequency of using each of the standard cells used by the systems; and

listing the standard cells according to a difference between a variable shaped beam (VSB) shot number, defined as a number of exposures of a one of the standard cells with VSB exposure, and a CP shot number, defined as a number of exposures of the one of the standard cells with CP exposure.

31. (New) The method as in claim 15, wherein said selecting further comprises:

listing the standard cells in order of frequency of use of each of the standard cells used by the systems;

listing the standard cells according to a difference between a variable shaped beam (VSB) shot number, defined as a number of exposures a one of the standard cells with VSB exposure, and a CP shot number, defined as a number of exposures of the one of the standard cells with CP exposure; and

creating a new CP aperture based on the listed standard cells if the CP apertures cannot satisfy the desired throughput.

32. (New) The method as in claim 15, wherein the systems are logic products, and the standard cells have shapes of the characters having shapes corresponding to the shaping holes are circuits having functions, the method further including:

making logic expressions for logic synthesis using the standard cells.

33. (New) The method as in claim 15, further comprising:

listing the standard cells on the CP apertures in effective order of CP effectiveness defined as a quotient of a product divided by a CP shot number defined as a number of exposures of the one of the standard cells with CP exposure, the product being a result of multiplying a frequency of use of each of the standard cells used by the systems by a difference between a number of variable shaped beam (VSB) shots, defined as a number of exposures of a one of the standard cells with VSB exposure, and the CP shot number.

34. (New) The exposure as in claim 4, wherein

the logic products are at least one of application specific ICs and system LSIs,
and

the standard cells having shapes of the characters having shapes corresponding to the shaping holes are at least one of an AND circuit, a flip-flop circuit, and an inverter.